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Industrial Clusters and Institutional Support: A Case Study The Plastics Cluster in the Montachusetts Region and it's Training Needs

Center for Economic Development

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The Plastics Cluster in the Montachusetts Region and it's Training Needs

Prepared for the Center for Economic Development

by

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1. Purpose

The purpose of this research and the dual papers is to comprehensively explore industrial clusters by looking at a number of examples, and then examine in greater detail, the Montachusetts Region in north central Massachusetts where the plastics industry has a strong base. The current weakness of the plastics industry will be identified and tackled.

The shift in organizational structure from global mass producing giants to industrial clusters that focus on flexible specialization, influenced many studies throughout the 1980s and 1990s. This paper will feed from these studies and expand on the role of institutional support networks.

2. Introduction

Industrial clusters are generally groups of rival firms, suppliers and customers within an industry that share a common geographical area with specialized research centers and skilled labor pools. There are a number of characteristics which are common to industrial clusters:

- Geographical Concentration of Firms
- Predominance of Small and Medium Sized Firms
- Vertical Disintegration
- Cooperative Competition
- Active Self Help Institutions
- Socio Cultural Identity which facilitates Trust

Clusters are not a new organizational structure but in recent years have been revived, and studied, by such economists as Becattini, whose model is named "Third Italy". Clusters of firms within an industry attract particular attention due to their apparent success in achieving a competitive advantage.

There is a dispute as to what constitutes an industrial cluster, their significance and whether or not their success can be sustained. What is certain, however, is that clustering can often achieve a competitive advantage.

3. Competitive Advantage

When a region's industry has lower costs, higher growth, exports goods or services to other regions, and has a greater propensity for profit and reinvestment than surrounding areas, then it is said to hold a competitive advantage. This advantage over other geographical regions has great effects on the community. Competitive advantage can translate into increased employment, tax revenue, and goods and services. Competitive advantage is therefore highly desirable.

3.1 Determinants of Competitive Advantage

Michael Porter, a Professor at the Harvard Business School, is perhaps the most prominent of current theorists on competitive advantage and industrial clustering. His writing is prolific and noteworthy.[1] Porter stresses the importance of innovation and rivalry in attaining and maintaining competitive advantage. His overall theory on competitive advantage is most clearly expressed in the 'diamond'. (See Figure 1)

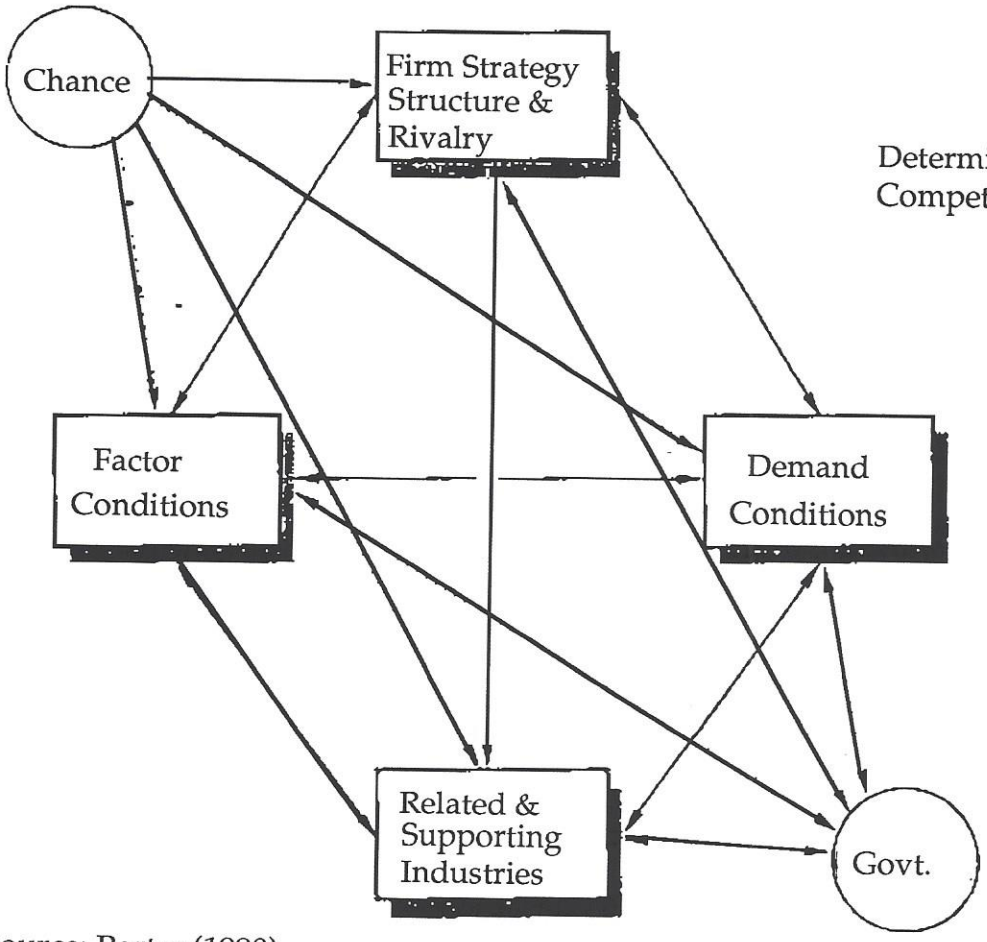


Figure 1

Determinants of
Competitive Advantage

Source: Porter (1990)

The diamond is a mutually reinforcing system which explains how competitive advantage may be attained. It shows the determinants of competitive advantage and how the effect of one determinant is contingent upon the state of the others. Porter emphasizes that each determinant must be continuously upgraded or else advantage will be lost. (Porter, 1990, 72)

The 'diamond' shows the following determinants:

- Factor Conditions
- Demand Conditions
- Related and Supporting Industries
- Firm Strategy, Structure and Rivalry

It also shows two external forces:

- Chance
- Government

Chance encompasses such developments as breakthroughs in basic technologies, pure inventions, and external political developments. Chance can affect competitive advantage, but cannot be controlled.

The role of Government in maintaining competitive advantage is more understandable. At all levels, Government can improve or detract from competitive advantage. Home demand for a product or service can be altered, training incentives awarded, taxes waived and education standards heightened. The Government interacts with all of the other determinants and plays a critical role in the maintenance of advantage.

3.1.1 Factor Conditions

Factors are, today, arranged by a more sophisticated method than the traditional land, labor and capital categorization. It is Factor Conditions which can be helped most effectively by institutional support.

A hierarchic arrangement of Basic and Advanced Factors ensures that focus is placed on those factors with a higher significance. Basic Factors include natural resources, climate, location, and unskilled labor. More complex factors such as a modern digital data communications infrastructure, highly educated personnel, or research institutes are classified as Advanced.

- Basic Factors are only important in extractive or agricultural industries, and those few industries which require only modest skill levels or technological requirements. Their importance has been diminished through widened availability and the increasing trend towards outsourcing. (Porter, 1990, 77)

- Advanced Factors are of far more importance to competitive advantage. A digital communications network can be critical for Just in Time (JIT) manufacturing and a

continuous supply of specialists/skilled labor ensures that technology can be used to capacity.

With improvements in technology and innovation, Advanced Factors will be demoted to Basic. The need for incessant upgrading of Factors means there is no room for a soft approach. Relaxation will result in the loss of competitive advantage.

Factors are also divided between those which are Generalized and those which are Specialized. Each may include Basic and Advanced Factors.

- Generalized Factors include highly skilled personnel and a good infrastructure within an area. These are vital for any industry, however to succeed, a competitive industry must have narrowly skilled personnel and an infrastructure which caters to its particular needs.

- Specialized Factors have a tendency to be Advanced. According to Porter, Specialized Factors provide a more decisive and sustainable basis for competitive advantage, however they also require more focused, and riskier investments. (Porter, 1990, 79)

A region must possess Specialized and Advanced Factors in order to maintain its competitive advantage. Those based on Generalized and Basic Factors will only last, 'until some new nation, often one advancing up the development ladder, is able to match them.' (Porter, 1990, 79) The Pax Americana era of pre 1970 is an example of a nation relying on this type of unsustainable competitive advantage, to be overtaken by Japan and later by the Pacific Tigers.

3.2 Summary

For factors to be continuously upgraded and competitive advantage to be sustained, support must be shown for the industry. This support comes in the form of institutional support which aims to address the needs of industry and the region, to harmonize them, and build a symbiotic relationship which strengthens both.

4. Industrial Clusters

Advantage tends to be achieved and sustained in industries which develop in a cluster. It may be achieved through a variety of interacting forces. These include both internal and external factors; for instance, good labor - management relations, and a highly skilled local labor supply are both critical elements for the maintenance of competitive advantage. Different theorists stress the importance of particular constituents.

Michael Porter believes that competitive advantage is ultimately derived from an innovative and intensely competitive environment. This extends not only to the competitive industry, but also to the suppliers and customers. A dependable supply of quality inputs is essential for timely delivery and swift orders. Sophisticated customers increase innovation through their demands for the most efficient and competitively priced goods. The dynamic environment created by fierce rivalry is the most important element according to Porter. (Doeringer & Terkla, 1995, 226)

Collaboration between firms is the focus of the study by Piore and Sabel. They advance that small firms should utilize their inherent flexibility and specialize in a niche market. (Doeringer & Terkla, 1995, 227) Through inter-firm cooperation in design, manufacturing and marketing, cost advantages can be secured which derive increased profit and funds for reinvestment. Firms can continuously meet the specialist needs of the customer. This flexible specialization depends upon Just-in-Time (JIT) inventory. This is based on production for custom orders. Stockpiling leads to depreciation and involves tied up capital. Today's markets insist upon liquidity and the swift delivery of custom goods.

Krugman, the macro-economist, stresses geographical advantages in his book *Geography and Trade*. (1991) He argues that economies of scale are imperative to competitive advantage. Low transportation costs, which allow for JIT delivery, encourage supplier firms to locate near the primary industry and generate a concentration of specialized labor. Competitive advantage will, he says, be maintained due to the organizational structure of the cluster and its propensity for information exchange, continuous learning and efficiency. (Doeringer & Terkla, 1995, 227)

4.1 Summary

Though Porter, Krugman and, Piore and Sabel all agree on the overall needs for securing competitive advantage, they differ in their opinions concerning the most important constituents for sustaining that advantage. All assent to the argument that clusters are an effective organizational structure to secure competitive advantage. The close proximity of firms breeds rivalry and competition, draws other firms relating to the industry, and allows for the cultivation of collaborative relationships.

4.2 Characteristics of Industrial Clusters

The range of industrial clusters around the world is vast. In virtually every industry, a cluster has emerged which, for a period of time at least, holds a competitive advantage over other regions. No two clusters are identical, however many agglomerations share common characteristics. The following characteristics are based on Becattini's Third Italy model for industrial clusters. The characteristic descriptions contain some examples of well documented clusters which evolved in a number of industries.

- **Geographical Concentration of Firms**

Firms tend to group in a close geographical region which has locational benefits to the industry. These benefits may be transport linked, resource linked or perhaps historically linked to the industry. For instance, a tradition of climbing boot manufacture in Italy was important in the ski boot industry's decision to favor Italy as a prime location for their factories. Geographical proximity encourages strong industry relationships between suppliers and producers.

The steel industry in Sheffield (UK) was concentrated around five rivers, water being a necessary resource in steel production. In the 1980s, high wages, frequent strikes, lack of demand and the easy availability of cheap steel from abroad gave Sheffield's main industry a terrrible blow and the city ceased to be the center of the steel trade. The historical links with this region have facilitated a rebirth of the industry in more specialized

applications. Sheffield Forgemasters makes componants which are used for the most challenging applications where strength, resistance to fatigue and corrosion are essential in product design. The UK's strong historical and geographical links with staple industries that lost their comparative advantages has led to more specialized applications of old industry, and they're doing very well. In the Queen's Awards for Industry (1997), companies are honored for their contributions to British industry. *Fresh Catch* of Aberdeen exports the finest fish from North Sea to Boston (USA), Nigeria and the Phillipines. The textile mills of West Yorkshire are once again noisy with the sound of looms spinning hard-wearing cloth for airline furniture rather than the luxury clothes fabrics of the nineteenth centuries. (FT,April 21 1997) Similarly in Massachusetts, Quaker Fabric Corp. has just invested $81 million in five old textile mills in Fall River. This investment in new equipment is to weeve furniture textiles, a shift from traditional to specialized high quality materials which have substantial value added. (The Boston Sunday Globe, May 11th 1997, C1)

- **Predominance of Small and Medium Sized Firms**

Rather than huge companies which are vertically integrated in their production, clusters are traditionally composed of small and medium sized firms. They are more specialized and due to their size, more flexible. Small and medium sized firms are perhaps disadvantaged in that they usually have less capital available for training.

The leather shoe cluster in the Sinos Valley, Brazil, began in the 1960s with a number of small artisan shoemakers. In 1995, there were some 400 shoe manufacturers, most specializing in women's shoes, and an additional range of firms producing inputs, markets for outputs and also providing special services to the leather shoe industry. (Schmitz, 1995, 9)

- **Vertical Disintegration**

A feature of the industrial cluster model is vertical disintegration. Most firms specialize in particular stages of a production process, making the location of suppliers critical. Just-in-Time (JIT) Delivery through local suppliers is important if vertical

disintegration is to accomplish increased efficiency. This specialization enables firms to focus their skills and technology towards a particular end product, or part thereof. This narrow focusing encourages innovation, advancement and a high quality product.

The Japanese electronics industry has traditionally maintained an integrated structure. Giants such as Toshiba and Sony not only produce end products but also semiconductors. A recent study explains however, that this 'structured flexiblity' is not as competitive as the American electronics industry's preferred 'flexible specialization'. The Japanese semiconductor industry is becoming disintegrated to overcome the disadvantages of being locked into internal suppliers in an industry where the pace of technology is so fast, and to comply with the need to have multiple technological inputs on the part of equipment suppliers to stay ahead in technological innovation. (Chon, 1997)

- **Cooperative Competition**

Competition, as Porter highlights, is important to the furthering of technology and the production of quality goods and services. However, competition should not exclude collaborative action for solving specific problems. Clustering usually leads to more harmonious relationships between rival firms and therefore the capacity for cooperation is increased. The geographical proximity of firms also leads to firm-switching and a high job turnover, inducing an exchange of information between companies. Should a particular process method be useless, then the exchange of this information could prevent other firms from going down the same path and wasting time. Information exchange may be detrimental for a single firm, but is essential across the industry.

In her book, *Regional Advantage: Culture and Competition in Silicon Valley and Route 128* (1994), AnnaLee Saxenian delightfully analyzes the success of the electronics industry in Silicon Valley. She concentrates on the role of competition and the community, stressing that the more relaxed, yet vibrant climate on the West coast encouraged innovation and a communal effort to be the best.

- **Active Self-Help Institutions**

For small and medium sized firms to compete effectively in the world market place, they require some form of institutional support. This may be for the purpose of marketing, financing, training, compliance with international standards, or to gather industry news. Self-Help Institutions may take the form of an industry association, a newsletter, training facilities, a Chamber of Commerce committee, or an educational establishment.

> Educational institutions were also critical to Silicon Valley's burgeoning technical infrastructure. By increasing enrollment in its Honors Cooperative Program, for example, Stanford offered an important advantage to small companies that sought to attract top talent but were unable to provide the continuing education and training needed in a fast-chnging technological environment. Stanford's Industrial Affiliates program promoted research collaboration between individual faculty, departments, and outside companies, further expanding the university's role in the region. (Saxenian, 1994, 41-2)

The community college system was also an important element of the West Coast technical infrastructure. These colleges were, 'particularly responsive to the needs of local business: they contracted with local companies to teach private courses for their employees, even holding courses at company plants to enable employees to attend after hours.' (Saxenian, 1994, 42) Local schools benefitted from donated equipment and companies often allowed students to use their equipment during the evenings.

- **Socio Cultural Identity which facilitates Trust**

A historical connection often assists firms to become more trustful of one another. If an industry has roots in a region then there is a camaraderie between firms which is effective for intra-firm communications. A population which recognizes mutual interests tends to socialize across corporate boundaries. This social interaction breeds trust between workers and can lead to innovation.

AnnaLee Saxenian's study of the West Coast electronics industry examines the role of an industrial culture in the region. 'The pioneers created a technical culture that transcended firm frontiers and functions. They developed less formal social relationships and collaborative traditions that supported experimentation.' (Saxenian, 1994, 30) The result was a flexible industrial system which was organized around the region and its 'professional and technical networks rather than around the individual firm.' (Saxenian, 1994, 30)

5 Industry Profile

The plastics industry in the Montachusetts Region of Massachusetts is a cluster which has developed over the last century.

5.1 History: The "Pioneer Plastics City"

The plastics industry has a long tradition in the Montachusetts Region. It is one of the areas oldest and most important manufacturing segments, and the area is likewise to the industry. Plastic was first used in the region to make combs. Comb manufacture in Leominster, using tortoise shell horn, dates from 1774 (Murray & Mory, 1996, 5), indeed by 1850 the city was known as "Comb City". The introduction of celluloid to the comb industry took place around 1900. Due to its flexibility, relative cheapness and abundant supply, celluloid became the industry staple.

As one of the first areas of the country to use plastics, the region became the center for fabrication and also for the manufacture of presses, molds, and fixtures. (Ibid, 7) The largest molding company in Leominster was the Foster Grant Company which began making injection molds in 1931. This company revolutionized the plastics industry in the United States and survived until the nationwide recession of 1991. (Ibid, 11) Moldmaking and commodity plastics firms grew and expanded around Foster Grant. Today there are around 176 companies in the plastics cluster.

The potential of plastics was only truly realized during the Second World War when manufacturers collaborated in the war effort. After the devastating loss of the comb market in the 1910s, with the evolution of flappers and the bob hair style, the armament needs of the war were critical to the growth of the industry. Wartime is always conducive to both invention and investment. The United States Government's defense orders ensured that Leominster factories were later prepared and technically able to produce the mass consumer goods that characterize the post war period.

Table 1

Evolution of the Montachusetts Region's Plastics Industry

1774	Obediah Hills relocates combmaking business from West Newbury, Massachusetts to Leominster
1850	Leominster, now known as the "comb city" was producing two thirds of the combs manufactured in the country
1895-1900	Transition period between the use of horn and celluloid
1896	Standard Tool Company established in Leominster
1911	Merchant's Bank established in Leominster by Bernard Doyle, an active lender for small celluloid and horn businesses
1914	"Birth of the Bob" devastates the region's combmaking industry
1919	Foster Grant Company established in Leominster
1930	Foster Grant begins first injection molding operation in the United States
1941-1945	Second World War expands market applications for plastic products
1955	Nylon Products Corporation established in Clinton
1977	Nylon Products Corporation changes name to Nypro
1990	National Plastics Museum opens in Leominster

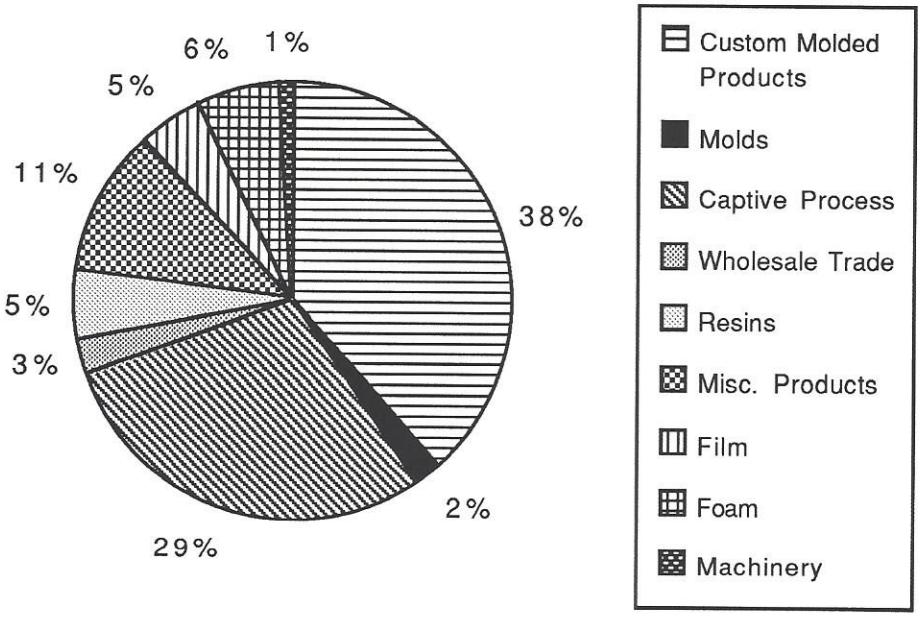
(Source: Murray & Mory, 1996, 11)

5.2 National Trends in the Plastics Industry

Plastics is an increasingly important sector of the United States manufacturing division. U.S. manufacturers of plastics raw materials, products, machinery and molds, employed more that 1.2 million workers in 1994. The distribution of employees by sector is shown in Chart 1. By far the most workers are employed in Custom Molded Products (38.4%)

Chart 1

Plastics Industry Distribution of Employees (1994)



Source: The Society of the Plastics Industry, Inc.

- The plastics industry has a presence in every state in the United States. The following table shows the 15 states which currently have the highest plastics industry employment and represent over 65% of total US plastics industry jobs.

Table 2

Plastics Industry Employment in the Top 15 States (1994)

Ranking High Growth 1991-1994	State	Total Jobs (,000s)	
1	California	80.7	
2	Ohio	76.6	
3	Michigan	69.3	34%
4	Illinois	61.2	
5	Texas	56.3	
6	Pennsylvania	46.0	
7	Indiana	43.6	
8	New Jersey	35.7	
9	New York	34.5	
10	North Carolina	27.7	
11	Wisconsin	26.9	
12	**Massachusetts**	**24.8**	
13	Tennessee	23.8	33%
14	Georgia	19.9	36%
15	Kentucky	18.5	

Source: The Society of the Plastics Industry, Inc.

Key points that this table illustrates are:

- The plastics industry is a large employer in Massachusetts (24, 800). Although many other states have far higher plastics employment, for instance, in California the number of jobs in the industry almost quadruples that of Massachusetts. (80,700)

- Michigan is both a strong player in the plastics industry and experienced high growth between 1991 - 1994. (34%) Prior to this growth, the industry was still larger than it was in Massachusetts in 1994.

- As with most manufacturing sectors, there is strong growth in the southern and mountain states. Georgia, Tennessee and Kentucky were all in the Top 15 states in terms of jobs, and Tennessee and Georgia were also high growth areas. The highest growing areas for the plastics industry between 1991 - 1994 were South Dakota (140%), Utah (61%) and Colorado (59%). It will be interesting to see if these states become the millennium states for attracting manufacturing industries in the United States.

5.3 Importance of Plastics Industry to the Montachusetts Region

Although ranked 12th in terms of employment, Massachusetts has the 4th largest plastics industry in the nation with 648 industry establishments employing over 24,000 workers State-wide. Of these firms, 176 are located in the Montachusetts Region forming an industrial cluster which the Commonwealth recognizes in its economic development plan *Choosing to Compete*.

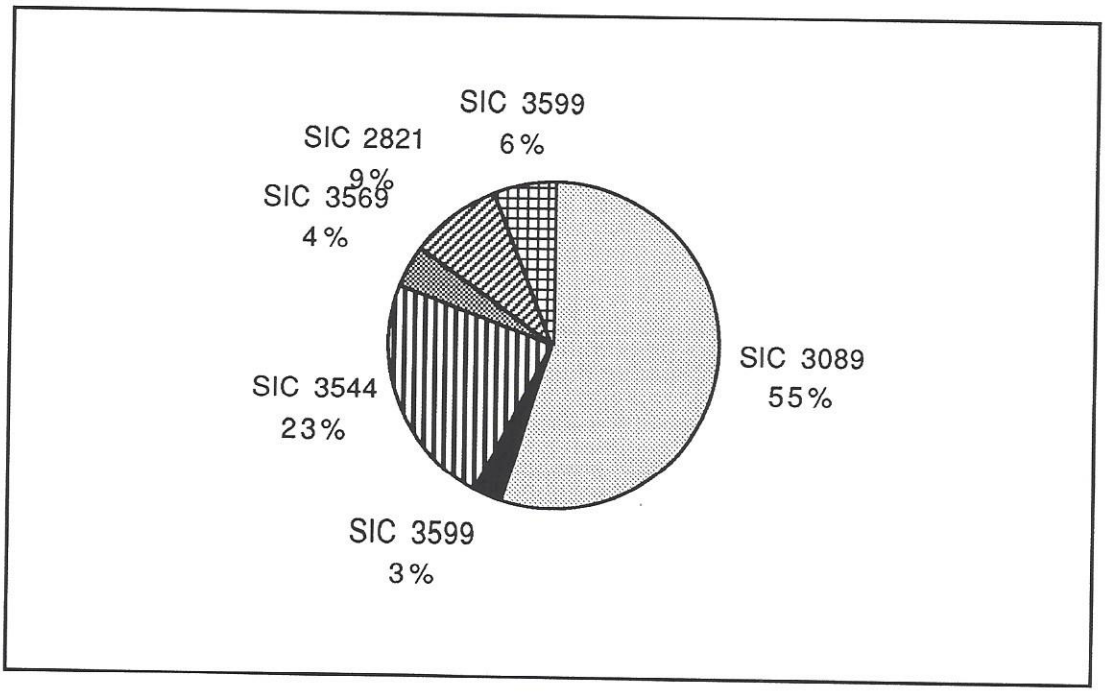
Between 1980 and 1990, employment in the plastics and rubber nondurable goods sector declined 22 percent despite US plastics employment increasing by 37 percent. According to the Department of Employment and Training this poor performance was partially due to Massachusetts' higher electricity and wage costs. This was the start of a trend in the manufacturing sector to locate plants in the southern regions of the US where there is generally cheaper labor, more tax incentives and less regulation than in New England. The 1991 - 2005 Projections published by the Department of Employment and Training in 1993 shows miscellaneous plastics products employment in the Commonwealth to have been at 16,700 and they anticipated a further loss of 3,200 jobs (leaving 13,500 jobs in the industry) by 2005. However with the pick up in the Massachusetts economy

and the strengthening of the plastics industry then Massachusetts has increased its employment in this sector and is now anticipating it to be a high growth area. Low expectations were probably due to the downsizing and closure of the General Electric Plastics Plant in Pittsfield. The Berkshire plastics companies were proactive and the formation of the Association of Plastics Indusy of Berkshire County and ultimately the Berkshire Plastics Network has helped that region to thrive.

The Montachusetts cluster has a far larger plastics tradition. 97 companies are classified under the Standard Industrial Classification (SIC) 3089 range which is Miscellaneous Plastics Products, and 40 companies are under SIC 3544 which is Tools and Dies, Die Sets, Jogs, Fixtures, and Industrial Molds.

Chart 2

Montachusetts Plastics Firms by Standard Industrial Classification (SIC)



Source: Murray & Mory, 1996.

5.4 Size of Firms

The plastics companies in the Montachusetts region vary in size, some having less than, or equal to, five employees and others having 300 or more. According to the study by Murray and Mory in 1996, plastics related firms average 45 employees.

5.5 Products

The commodities produced by the injection molding firms vary in their sophistication. There are those companies such as Plastican Inc. and Holiday Housewares Inc., which produce more basic household and functional products such as containers, buckets and plastic cutlery, and there are many who produce items which are sophisticated and have a lot of value added. Acro-Matic Plastics Corporation produces fine commodities for the medical, automotive and computer sectors, with zero error tolerance, at their Leominster plant. This variety of products leads to a healthy industrial cluster.

5.6 Ownership

The long history of plastics in Leominster has facilitated the growth of many locally owned start-up businesses. The 1996 survey orchestrated by Murray & Mory had a 40% reply record and of those that replied, 95% indicated that the firm originated in the greater Leominster region. (Murray & Mory, 1996, 42) The majority of this growth took place just after the Second World War when in the ten year period following the war, the number of plastics firms quadrupled. (Murray & Mory, 1996, 37)

2.6 Conclusions

The plastics industry is long established and thriving in the Montachusetts region of Massachusetts. There are both large and small firms, producing diverse products in a technologically expanding area, and most have strong roots and an affinity with the region. It is not typical in that it has a certain amount of vertical integration, and the cluster is under threat from the lack of institutional support provided, especially comprehensive training.

Part 2

1 Introduction

Massachusetts is admired for its great academic institutions, its research and innovation, and the pioneering Yankee determinism that strives for success. Yet this same state has suffered from an arrogance that threatens its competitive advantage. This arrogance and naivety revolves around the issue of training.

World renowned educational establishments and cutting edge technology have been the focus of Massachusetts' business and government throughout the 1980s and 1990s, while the basic training of the Massachusetts blue collar workforce has been perilously ignored. The Boston Sunday Globe quoted Paul A Getman Jr., president of Regional Financial Associates of Pennsylvania, '*there was an arrogance toward manufacturing ...vocational training was neglected.* ' (Boston Sunday Globe, May 11th 1997, C15)

The Montachusett Region of north central Massachusetts is a typical example of an area rich in manufacturing history and modern business. The region's plastics industries are in expansion mode, use applied technology, export goods and enjoy international recognition ... in short there is success. Of immediate threat, however, is the lack of effective training initiatives. The competitive advantage of this region's plastics industries is in immediate jeopardy.

This paper researches the training requirements of the plastics industry, looks at the training establishments available in the area at present, and makes recommendations on what should be done to maintain the regions competitive advantage through facilitating better training resources.

2 The Plastics Industry Workforce

2.1 Occupations in the Plastics Industry

Occupations in the plastics industry used to be a combination of both blue and white collar jobs. These demarcations are still true, however, with the increasing use of high technology hardware and programs such as CAD / CAM, the average line worker needs some competancy with computers and software. As an educator pointed out, at the Plastics Industry Presentation on May 20th 1997, the traditional bi-polarization of skills is no longer suitable to the plastics industry, "stripy shirts" are needed.

The occupation list runs to approximately 110 different job titles, however the main occupations are:
Assembler /Packager
Mold-Die Setter
Plastics Machine Operator
Service Operator / Utility Person/ Floor Person
Tool and Die Maker - Mold Maker

There is great variation in the wage rates for these different skills, which is later discussed in 4.7 . Naturally these only encompass the fundamental jobs of the industry and not the support, or research and development occupations. It is however, these manufacturing occupations which require the most attention in terms of training.

2.2 The Aging Workforce

The trend over the past 20 years has been for young college graduates and even high school graduates who are interested in a manufacturing career to approach the electronics industry around the Rt 128 and I 495 in Massachusetts. There has been little encouragement for young people to join the plastics industry and therefore the workforce is indeed aging.

This phenomenon is especially true, and therefore critical, in the moldmaking sector of the industry. It is vital that young, intelligent high school graduates are informed of the benefits of such a career. If action is not taken, the industry will suffer greatly. As Dr

Mullin brought to the industry's attention at the Plastics Presentation, the City of Gardner lost its furniture business as it did not use the skills that were lying dormant in the area. This should not happen to the plastics industry if it can revitalize the training inititives which are, at present, confused and disorganized.

2.3 Women in the Plastics Industry

While at present, the role of women in the plastics industry is low, there has been an initiative that encourages women to enter the plastics industry and advance to higher than their traditional level. Most women employed in the industry are at entry level jobs which require little skill deployment. The Leominster Center for Technical Education has been awarded a US Department of Labor grant to fund a program specifically tailored to women. (Murray & Mory, 1996, 69)

2.4 Recruitment

Recruitment in the plastics industry in the Montachusetts Region is based on a number of strategies. They include newspaper advertisments, in-house postings, and also the use of agencies. Mr John Clementi, President of Plastican Inc. , considered that his company makes great use of the agency network. Plastican's Human Resources Director, Deanna Zarrella, explained that they do use different agencies depending upon the level of skills required in a worker, however this was their main source of labor. There is some school recruitment, however it is not fully explored, perhaps due to the level of organization involved in such a project.

2.5 Pay Rates

The plastics industry has a tradition of providing long term careers with excellent wages and benefits. In 1995 the North Central Massachusetts Chamber of Commerce carried out a Wage and Salary Survey which provided some approximate figures for specific occupations in the plastics industry.

Table 1

Wage Rates for Plastics Industry, Montachusetts Region (1994)

Occupation	Actual Low	Actual High	1994 Average	1990-1994 % Change	Total no. of Employees
Assembler /Packager	$4.49	$9.77	$7.33	11%	249
Mold-Die Setter	$7.75	$19.23	$11.36	8%	53
Plastics Machine Operator	$5.25	$19.13	$7.70	11%	647
Service Operator / Utility Person/ Floor Person	$5.75	$10.22	$8.57	17%	125
Tool and Die Maker - Mold Maker	$7.00	$24.00	$15.62	18%	57

Source: North Central Massachusetts Chamber of Commerce

This survey shows across the board increase in the wages of the plastics workforce between 1990 - 1994. The highest reported wages in the SIC 3089 range were $19.23 for Mold-Die Setters and $19.13 for Plastics Machine Operators. However in the SIC 3544 range, the Tool and Die Maker - Mold Maker made, on average, $15.62 with the highest wages being $24.00. According to *The State of the Platics Industry* , the higher wages and salaries for experienced mold makers are substantiated by recent job advertisements in the region that show mold makers earning salaries as high as $54,000 per year. (Murray & Mory, 1996, 40)

These high wages for technically qualified people should attract high school and community college graduates to the plastics industry. However in the Montachusetts Region, it appears that insufficient marketing of the industry and its potential is targeted at educators and students.

2.6 Shaping the Workforce of the Future

There are various needs which have become apparent in assessing the training requirements of the plastics industry in the Montachusetts Region. Taking a holistic view of the situation, the smaller firms are looking for specific skills whereas the larger companies seek well rounded individuals with a mastery of basic skills and a proficiency with the English language. Both sizes of company emphasize their need for people with moldmaking experience.

4.7 Image of the Plastics Industry as an Employer

As previously discussed, the plastics industry has not been well marketed over the past 20 years as an exceptional workplace. This will change as the region becomes more aware of the needs of the industry and recognizes the potential of the high school graduates and indeed those graduates with an Associates, Bachelors, or Masters degree from any of the reputable educational establishments in the region.

The opening of the National Plastics Museum in Leominster in 1991 was a grand moment in the publicizing of the plastics industry. Its location in Leominster has brought attention to the City and its industry. There are a number of exciting exhibits and the Plastivan is a touring educator which aims to inform young children and upwards of the usefulness of plastics, its recycling capabilities and of the dynamic nature of the plastics industry for the new millenium.

2.8 Recount of Situation

It is apparent at this stage, that the marketing of the industry and its job potential is needed. This has been sorely neglected in recent years and will be required for the launching of a new era in the plastics industry.

3. Training Practices

There are training initiatives in place in the region. They will be briefly described below. These different programs are splintered and should be organized in a more user friendly way.

3.1 On-the-Job Training

On the job training is perhaps the most effective way of advancing the careers and skills of those people already employed in the plastics industry but at a low level, or indeed for those who work in the hi-tech areas which are constantly changing. Courses are offered at a number of establishments including Fitchburg State College, Mount Wachusett Community College, University of Massachusetts: Lowell, and Worcester Polytechnic Institute. The majority of these courses, which range from a Certificate to a Masters Degree, are taught in conjunction with the Nypro Institute at Clinton.

The Nypro Institute, being in private industry, is the most technologically advanced training resource in the region. The Nypro Institute's mission statement, "To foster a learning environment within Nypro that encourages the continuous improvement of all employees and our customers, worldwide, in support of strategic corporate objectives," emphasizes the need for training to ensure quality and productivity.

Nypro offers joint courses and seminars, covering a subject intensly and comprehensively, over a 2-3 day period. The facilities and seminars are available to local manufacturers at a reduction of up to 40 percent due to a partnership with the Central Massachusetts Manufacturing Partnership (CMMP). The CMMP is one of five regional resources established to assist the small and medium-sized manufacturing industries in the Commonwealth.

There is hesitation on the part of many companies in using these resources as many managers and owners fear that training through the Nypro programs will encourage their employees to transfer to either Nypro or another, more highly paying, company on completion of their training. This fear and suspicion needs to be overcome if success is to be expected. The cooperation between different companies and educators requires strengthening.

3.2 Apprenticeship Training

For the high school or vocational school graduate, this is the most informative and gratifying experience. Companies have expressed interest in developing appreticeship programs, however, it takes a formal link between themselves and educators to devise a program. This link is, at present, missing and needs attention. The Leominster Center for Technical Education and the Montachusett Regional Vocational Technical School in Fitchburg are ideally suited for a formal partnership with the industry. The Center for Technical Education is becoming increasingly successful and the machine shop program has expanded from six to 50 students over the past five years. The Center has 16 CAD stations, CNC programming, and is keen to progress. These institutions are centrally located in the Montachusetts Region and, have the equipment and expertise to train the majority of lower level workers in the plastics industry.

3.3 Basic Academic Upgrading

In terms of basic skills and English as a Second Language certificates, there are many institutions which offer courses. It is recommended that courses are tailored specifically to the needs of the plastics industry (or manufacturing in general) and that some technical language is included.

3.4 Alternative Training Delivery Systems and Training Effectiveness

Video Instructional Programs have become very popular for in-house training. Springfield Technical College has developed a number of courses by this means and they are increasingly successful. These programs allow workers to remain in their familiar surroundings and therefore they are more at ease with the equipment, but have expert tutoring which can be replayed to cover the most important points. The drawbacks are that there is no interaction between teacher and the taught, indeed Springfield Tech considered VIP to be largely unsuitable for the plastics industry. Ofcourse this is not concrete and each course varies in its needs. The key is flexibility.

3.5 Job Training Resources in the Commonwealth of Massachusetts

There are a number of initiatives in the Massachusetts bid for increased economic development. These include Regional Employment Boards, Job Matching Service Centers, and Private Industry Councils. The Montachusetts Region has all these organizations and more, perhaps has too many organizations.

Of a more tailored nature are the manufacturing networks which are popular in today's economy. These are administered in Massachusetts by the Bay State Skills Corporation. The following table shows the objectives of the Bay State Skills Corporation.

Table 2

Bay State Skills Corporation

"A principal component of the Commonwealth of Massachusetts' economic development effort to create, develop, and implement innovative workforce improvement and workplace assistance programs"

Objectives

- Assist businesses, particularly small and medium-sized manufacturers, to enhance their competitiveness.

- Prepare youth and the current workforce for the twenty-first century.
- Link the public and private sectors to achieve common economic development goals.
- Apply emerging technology and information to economic development.

Source: BSSC Webpage

Bay State Skills Corportation is a quasi-public corporation which is led by a Board of Directors comprising of public officials, business executives, educators and interested citizens. Their mission is to 'prepare the Massachusetts economy for the next century through innovative programs and services that enhance the skills of workers and advance the competitiveness of firms.' (BSSC Webpage)

It acts as an umbrella organization for diverse support institutions. There are four main components and subsequent offshoots.

- Training Services
- Center for Youth Development and Education
- Manufacturing Services
- Center for Women, Work, and Family

4 Recommendations

The following are recommendations to a local planning agency for the efficient organization of the training resources in the Montachusetts Region.

GOAL Retention and Expansion of the Plastics Industry in the Montachusetts Region

Short Term Objectives

- Create an Executive Task Force to oversee the development of a Training Initiative. This Task Force will pave the way for a more formal cooperative program catering to the plastics industry such as a Manufacturing Network.
- Hire an intern to research other plastics industry clusters in the US. This intern would provide a comprehensive summary of strategies and also inventory the available training programs in the Montachusetts Region.
- Coordinate a charette for participation by private industry to identify their perceptions of the Strengths, Weaknesses, Opportunities and Threats facing the plastics industry workforce.
- Stipulate that only those companies that maintain involvement will be provided with the end results of this development project.
- Organize an informal conference for local educators, at which they may meet with one purpose in mind - to fulfill the needs of the plastics industry.

Medium Term Objectives

- Establish an administrative office for the plastics industry. This would coordinate training programs and act as an informational service for the training needs of the plastics industry.
- Create infrastructure that is conducive to further investment in the region by the plastics industry. This includes road maintenance, an inventory of available industrial land, a fast permitting process and a plastics figurehead in local government to represent all parties.

Long Term Objective

- Develop a National Center for Plastics at the present National Museum of Plastics. This need be no more than an office which acts as an information service and serves as the one point of initial contact for private industry. This should be managed full time by a professional who has experience in the plastics industry and 'knows the language'.

Not only will this Network HQ serve the training needs of the industry but will also market, promote and arbitrate on behalf of the industry as a whole (not for individual companies). It will produce a newspaper and will organize seminars on such topics as ISO Certification and International Trade.

This Center would be a virtual university in that it is the focal point of information exchange.

5 Conclusion

If the plastics industry is to be retained in the Montachusetts Region, the community needs to address the industry's requirements. The communication barriers which are at present in place need to be broken down and a collaborative approach be taken. This involves communicating, marketing and analysis.

The Montachusetts plastics industry promises to thrive if all parties are proactive and take on the task of addressing the industry's training needs

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[1] *The Competitive Advantage of Massachusetts* was adopted by the Governor of Massachusetts as the basis of the state publication *Choosing to Compete - A State wide Strategy for Job Creation and Economic Growth.*